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Fiscal Year 2001 Annual Report on the University Programs of the Advanced Accelerator Applications Program

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Abstract–*The Advanced Accelerator Applications (AAA) Program was initiated in fiscal year 2001 (FY-01) by the U.S. Congress, the U.S. Department of Energy (DOE), and the Los Alamos National Laboratory (LANL) in partnership with other national laboratories. The AAA Project and the R&D for its underlying science and technology will require a large cadre of educated scientists and trained technicians in the future. In addition, other applications of nuclear science and engineering (e.g., proliferation monitoring and defense, nuclear medicine, safety regulation, industrial processes, and many others) require increased academic and national infrastructure and student populations. Thus, the DOE AAA Program Office has begun a multi-year program to involve university faculty and students in various phases of the Project to support the infrastructure requirements of nuclear energy, science and technology fields as well as the special needs of the DOE transmutation program. Herein I summarize the goals and accomplishments of the university programs that have supported the AAA Project during FY-01, including the involvement of more than eighty students.*

I. INTRODUCTION

The Advanced Accelerator Applications (AAA) Program was initiated in fiscal year 2001 (FY-01) by the U.S. Congress, the U.S. Department of Energy (DOE), and the Los Alamos National Laboratory (LANL) in partnership with other national laboratories. The primary mission of the AAA Program is development of technology for transmutation of nuclear waste and demonstration of its practicality and value for long-term waste management. Other goals are to help revitalize the U.S. nuclear infrastructure, to provide a test-bed for advanced nuclear projects, and for the U.S. to resume an international leadership role in nuclear technologies. This new science and technology will require a large cadre of educated scientists and trained technicians in addition to that required for our broader national nuclear infrastructure.[1, 2]

During the next decade, the nation will need additional nuclear scientists and engineers for national security programs like counter-proliferation, global monitoring activities, stewardship of our nuclear stockpile, and naval nuclear propulsion. We will also need more college graduates for design and federal regulation of next-generation reactors, and we will need young people for nuclear medicine and medical research using radioisotopes. We will need still more for expanding industrial radiation applications such as manufacturing, oil and gas exploration, and irradiation to sterilize hundreds of consumer products and most medical equipment. In addition, we'll need a larger nuclear workforce for irradiation of food as well as livestock feed to eliminate pathogens like Listeria and e-Coli from our food, Hoof-and-mouth from our feedstock and Anthrax from our mail.

Because of the requirements for educated scientists and engineers in a wide variety of nuclear- and accelerator-related fields, the DOE AAA Program Office has begun a multi-year program to involve university faculty and students in various phases of the AAA Project. This report describes ongoing university programs and new initiatives that are supporting both the research needed for transmutation and the national nuclear infrastructure. These past programs include the ATW Project at the University of Michigan, the University of California at Berkeley, and the University of Texas at Austin. Current programs include ongoing university research, a University Participation Program (AAA UPP) at the University of Nevada, Las Vegas (UNLV), and a new University Fellowship Program (AAA UFP) that is managed for DOE/NE by the Amarillo National Research Center. The report begins with a description of student support during the year.

II. AAA STUDENT SUPPORT

A significant aspect of the AAA Program is that it supports a substantial U.S. student population. These students are supported through the AAA University Fellowship Program, the UNLV AAA University Participation Program, research contracts with three universities, and internship programs at national

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laboratories. This year, more than 80 students were supported by FY-00 and FY-01 AAA funding (this included both AAA and APT funding). In addition, students worked on AAA-related research with support from other DOE programs (special student programs, other research projects, etc.) We expect the number of students who are supported by AAA funding to increase with additional support from FY-02 funding. The following sections briefly describe the different AAA categories of student support, and the information is summarized in Table I.

Table I.
Summary of Annual AAA Student Support

Total:	~87	students supported by FY-01 AAA Project funds
Laboratory interns at LANL and ANL-W	14	(count does not include 3 of the AAA Fellows)
Indirect-support interns at ANL	~6	(estimate)
AAA University Fellowship Program	10	
UNLV AAA University Participation Program	40	(21 graduate and 19 undergraduate students)
Directed University Research Programs	12	
Seaborg Transactinium Science Institute Summer School	5	

II.A. Direct Support for Laboratory Intern Students

The national laboratories employ students, from undergraduate to Ph.D., to provide administrative assistance and to conduct critical scientific research. Most interns conduct research during the summer, however, several students are supported during other portions of the year, and Ph.D. students work at the laboratories year-round. Seventeen high school, undergraduate, and graduate students were supported directly by FY-01 AAA funding (fifteen at LANL and two at ANL-West). This total includes three of the AAA Fellows mentioned in the AAA UFP Students section below (they are counted with the "AAA UFP" category for the summary in Table I, not here).

II.B. Indirect Support for Laboratory Intern Students

The AAA Project at Argonne National Laboratory-East employed several students who are conducting research on AAA-related topics. Because of the employment mechanisms used at ANL, they were not funded directly from AAA Work Packages. However, an estimated six students who were supported at ANL-East are included in this category.

II.C. UNLV AAA UPP Students

Students at UNLV are employed in research projects and as support to the project administrators in the Harry Reid Center for Environmental Studies (some of this support to administrators is technical in nature, however). Twelve approved research projects (described in a later section) included about 14 undergraduate and 21 graduate (Masters and Ph.D.) students. These students were from several colleges at UNLV, including Health Physics, Engineering, and Sciences, and from several departments within those colleges. The Director of DOE/NE recognized the research projects as being highly interdisciplinary, cutting across departments and even colleges.

II.D. AAA UFP Students

During the summer of 2001, three AAA Fellows chose to work at the national labs. One student worked at LANL developing oxygen sensors for the new lead-bismuth loop experiment; the other evaluated cost parameters used in international studies and reports on transmutation systems. The third student worked at ANL-W on a fuel fabrication project. After the summer, all ten Fellows began their course- studies and research projects contributing to their Masters degrees. Many of these students collaborated directly with technical staff at LANL, ANL, and ANL-West to formulate their Masters thesis topics so that they will directly benefit the AAA Project. In addition, these students will be prepared work at the labs in 2002, coming to work with a comprehensive knowledge of the technology needs in their respective areas. They will be ready to "hit the ground running."

II.E. AAA Directed University Research Students

Several students conducted AAA research at Michigan, Berkeley, and Texas. Because of program changes, graduations, and mid-year transition from FY-00 to FY-01 contracts, the exact number of students supported under this project would be misleading. On a

year-round, average basis, approximately twelve students are funded by these AAA Directed University Research projects.

II.F. Seaborg Institute Students

In addition to the programs that provide direct research support to the AAA Project, in 2001 DOE/NE sponsored five students to attend the Glenn T. Seaborg Institute for Transactinium Science (GTS-ITS) Summer School at Lawrence Livermore National Laboratory. Of these highly qualified students, two were fully supported and three were partially supported.

III. DIRECTED UNIVERSITY PROJECTS

In fiscal year 2000 (FY-00), the Accelerator-driven Transmutation of Waste (ATW) Project began as a $9M effort following a decade of laboratory-funded research at Los Alamos National Laboratory. During the ATW Project, Los Alamos National Laboratory contracted with three universities—the University of California-Berkeley, the University of Michigan, and the University of Texas-Austin—to support ongoing research in transmuter design and analysis, in planning for experiments, and in assessing proliferation-resistance attributes of separations and transmutation technologies. Research projects at these three universities have employed undergraduate and graduate students during that past academic year.

III.A. University of California at Berkeley

Faculty and students at the University of California-Berkeley conducted research to evaluate designs of transmuters and to optimize the destruction of neptunium (the isotope of primary concern for long-term storage).[3] In one design study of a once-through, graphite-moderated $NaF\text{-}ZrF_4$ molten-salt reactor, its potential for transmuting ^{237}Np and its precursors was examined. If one could be built economically, a molten-salt transmuter with continuous removal of all fission products offers a remarkably high fractional transmutation, greater than 90 percent, but only if concentrations of actinides in the molten salt greatly exceed the current known limit of 2 percent. Berkeley researchers learned that thick fuel channels produce strong self-shielding effects, particularly for transmutation of ^{240}Pu, so heterogeneous calculations are required to determine accurate isotopic composition and fractional transmutation. They determined that for a given feed rate of heavy metal, smaller feed/removal rates result in longer mean residence times, increased overall transmutation effectiveness, and lower k_{eff}. And for a given graphite-moderator lifetime (with respect to radiation damage), thinner channels achieve greater transmutation. Other conclusions of this analysis of molten-salt transmutation reactors are discussed in a paper that was submitted for presentation at the Winter Meeting of the American Nuclear Society in Reno, NV.[4]

Several faculty members and students have been supported by both FY-00 and FY-01 AAA funds while conducting research for or connected to the AAA R&D efforts. In addition, several students have worked on code systems that have directly benefited AAA research needs while supported by funding from other programs, such as the Nuclear Energy Research Initiative (NERI), the Nuclear Engineering Education Research program (NEER), and Generation 4 roadmap and reactor studies projects. One example of this synergy was a project to compare lead-bismuth-cooled and sodium-cooled transmuter systems.

III.B. University of Michigan

At the University of Michigan, several faculty and students have supported the ATW Project with studies for the design of integral experiments as well as evaluations of a variety of technical issues. The faculty have acted as "honest brokers" to provide comments and advice during systems studied, reactor studies, and the development of concepts for future experiments. In addition, students have completed considerable work and thesis studies.

Three papers that were submitted for presentation at the Winter Meeting of the American Nuclear Society in Reno, NV describe results of ATW research projects at Michigan. In one, mono-energetic neutron sources of sufficiently high energy (e.g. 14 MeV) to contribute to the science of accelerator-driven transmutation in lead and bismuth moderators are shown to produce flux depressions just below the source energy.[5] In the work reported in another companion paper, neutronics tools were compared to validate design methods.[6] In another project, a Michigan student developed numerical algorithms based on a two-dimensional time-dependent diffusion theory code that can accurately account for step changes in localized sources in time.[7] This involves separate treatments for the shape-function and amplitude-function calculations that can represent prompt space-time variations in neutron flux within the quasi-static formulation. Other work at Michigan has included design and analysis of transmutation systems, integral experiments for fuel, reaction rate, and other studies, and prioritization of research requirements.

III.C. University of Texas at Austin

A FY-00 research project was completed at the University of Texas-Austin to evaluate the impacts of ATW on proliferation resistance of separations, fuel fabrication, transmutation, and disposal.[8] They have begun the development of a set of high-level metrics in conjunction with research staff at Sandia National

Laboratories to compare the "International Acceptability" of proliferation risk from transmutation with the risk from the once-through fuel cycle. Two faculty members and several students have participated in this research project during FY-01, during which they were supported by both FY-00 and FY-01 AAA funds.

IV. CURRENT UNIVERSITY PROGRAMS

During FY-01, research and development of ATW technology was expanded, the project was combined with the Accelerator Production of Tritium Program, and it was re-named the Advanced Accelerator Applications (AAA) Program. Increased academic participation was one of the major goals of the AAA Program, which includes continuation of directed university research as well as new university programs. An integral component of the AAA Program is continued Directed University Research at Berkeley, Michigan, and Texas. This continued research leverages the Project's prior investment in computer systems, software, and other resources and in faculty expertise, and it gives us the opportunity to increase the value of research conducted by faculty and students at these institutions. In addition to these current research projects, the AAA Program has implemented two major new university programs. A $3 million University Participation Program (AAA UPP) was begun at the University of Nevada, Las Vegas, and a new University Fellowship Program (AAA UFP) was started which is managed for DOE/NE by the Amarillo National Research Center.

In accordance with the public law that established the AAA Project and the UNLV funding, the UNLV AAA UPP will include "… research and development of technologies for economic and environmentally sound refinement…" of used nuclear fuel. Student-conducted research has begun, and substantial improvements to infrastructure at the UNLV are underway. The $500 k AAA UFP fellowship program, which began earlier this year with a competitive application process, supports ten highly motivated students who began working on projects that support the research and development needs of the AAA Project. In addition, a number of students, from high school through doctoral, were employed at the national laboratories in support of the AAA Project. These new programs are described below.

V. AAA UNIVERSITY PARTICIPATION PROGRAM

The UNLV AAA University Participation Program (UNLV AAA UPP) was designed to benefit the National AAA Project and the University's goals to enhance student-focused and internationally recognized research programs. Early in the year a proposal and strategic plan were developed. The contract was completed in the spring, a management and research infrastructure was established, and the program was implemented very quickly. Support from UNLV administration and faculty has been extremely good. The strategic plan to accomplish the objectives of AAA management and university administrators has the following three main components:

1. Program Support to ensure the smooth operation of the UNLV AAA UPP and all non-research functions such as maintenance of communication links and information management, organization of workshops and conferences, and administration of the competitive proposal process;
2. Research Infrastructure Augmentation under which the UNLV nuclear research infrastructure is being enhanced through the hiring of new researchers and the acquisition of scientific equipment to allow researchers to perform more AAA-relevant research on campus; and,
3. Student Research to support projects at UNLV on tasks relevant to AAA research and technology development needs.

The Director of the UNLV AAA UPP has provided quarterly reports, has submitted an overview report to a national conference,[9] and has given presentations at reviews and national meetings that describe the vision and implementation of this new program. These presentations and reports include descriptions of the research projects that were underway in the first year of the program, important decision points, and a new paradigm in grant research exemplified by the program. Immediately after funding was established for the UNLV AAA UPP, four projects were competitively selected for research beginning the summer of 2001, and another eight were selected for fall starts.

To initiate these research projects, UNLV hosted technical staff from the national laboratories in a series of seminars and technical working meetings. The seminars were conducted on an almost-weekly basis to expose the faculty at UNLV to the widest possible array of AAA research needs. The purpose of these seminars and visits was to develop collaborative research projects where the lab technical staff members and the UNLV faculty and students would work together directly. Staff from ANL visited several times and presented seminars to develop research projects on used-fuel separations, staff from LANL visited to develop accelerator projects and materials research projects, and staff from ANL-W visited to develop research projects related to transmutation fuels and fuel fabrication.

To illustrate the kinds of research projects that are being conducted at UNLV, the first four of these projects are described in the following:

- "Design and Analysis for Melt Casting Metallic Fuel Pins Incorporating Volatile Actinides" is a project in the UNLV Mechanical Engineering Department that is being conducted in collaboration with Argonne National Laboratory-West. In this project students

will investigate methods and equipment to cast fuel pins for transmutation while preventing the evaporation of volatile actinides such as americium. The Principle Investigator (PI) is Prof. Y. Chen, and the laboratory collaborator is Mitchell Meyer (ANL-W).

- In a project titled "Experimental Investigation of Steel Corrosion in Lead Bismuth Eutectic: Characterization, Species Identification, and Chemical Reactions," UNLV Physics Department faculty and students initiated a program to investigate experimentally the corrosion of steels by Lead-Bismuth Eutectic. Corrosion products and related chemical reactions will be identified using facilities at UNLV for the Scanning Electron Microscope (SEM) and x-ray diffraction (XRD). Thirty samples of steel now at UNLV were exposed to high-temperature LBE and have been analyzed by Russian scientists. Several samples have been examined with the SEM, and the most recent experimental results were included in another paper that was submitted for presentation at the ANS Winter Meeting in Reno.[10] The PI is Prof. R. Schill, and the laboratory collaborator is Ning Li (LANL).
- Researchers in the Department of Mechanical Engineering will investigate "Hydrogen-Induced Embrittlement of Candidate Target Materials for Applications in Spallation-Neutron-Target Systems, Phase I" with LANL scientists and engineers. The PI is Prof. J. Farley, and the laboratory collaborator is Ning Li (LANL).
- "Modeling, Fabrication, and Optimization of Niobium Cavities" is a collaboration between the Department of Electrical and Computer Engineering, the Department of Mechanical Engineering, and the AAA Technology Project Office (Superconducting RF Engineering Development and Demonstration). In this project researchers will perform research to maximize the performance of the accelerator cavities by studying multipacting (a localized resonance process resulting from the impact of electrons on cavity surfaces), by studying the effect of chemical etching on cavity surface roughness, and by redesigning cavities. The PI is Prof. B. O'Toole, and the laboratory collaborator is K. C. D. Chan (LANL).

Other research projects can be viewed by visiting the UNLV AAA Internet site: aaa.nevada.edu. Their titles are:

- S. Moujaes, "Modeling Corrosion in Oxygen Controlled LBE Systems with Coupling of Chemical Kinetics and Hydrodynamics," (lab collaborator Ning Li, LANL)
- C. Hull, "Neutron Multiplicity Measurement for AAA Target/Blanket Materials," (lab collaborators Mike Todosow, BNL, and Eric Pitcher, LANL)
- P. Patton, "Develop Dose Conversion Coefficients for Radionuclides Produced in Spallation Neutron Sources," (lab collaborator Brent Boyak, LANL)
- Y. Chen, "Development of a Systems Engineering Model of the Chemical Separations Process," (lab collaborator Jim Laidler, ANL)
- G. Mauer, "Design and Evaluation of Processes for Fuel Fabrication," (lab collaborator Mitch Meyer, ANL-W)
- A. Roy, "Development of a Mechanistic Understanding of the High-Temperature Deformation of Alloy EP-823," (lab collaborator Stuart Maloy, LANL)
- W. Culbreth, "Nuclear Criticality Analysis for the Transmuter Fuel Fabrication and Reprocessing Process," (lab collaborator George Vandegrift, ANL)
- W. Culbreth, "Radiation Transport Modeling of Beam-Target Experiments for the AAA Project," (lab collaborator Ray Klann, ANL)

VI. AAA UNIVERSITY FELLOWSHIP PROGRAM

This year the AAA Program Office in DOE/NE established a new fellowship program that is administered by the Amarillo National Research Center, a consortium of Texas Universities. This new program was intended to support top students across the nation in a variety of disciplines that will be required to support AAA research and technology development in the coming decade. In the first year, ten AAA Fellows were selected from a large pool of highly qualified applicants. The students who were awarded Fellowships are attending graduate school at the following institutions: the University of Illinois-Urbana/Champaign, the Massachusetts Institute of Technology, the University of Texas-Arlington, the University of California-Berkeley, the University of Massachusetts-Lowell, the University of Texas-Austin, the Ohio State University, Texas A&M University, and the University of Michigan (Chemical Engineering and Nuclear Engineering Departments). These students are working on a variety of topics as they conduct research for their Masters theses and degrees. Topics that were identified include chemical separation processes and modeling, fuel development and fabrication, analysis of results from in-beam experiments at the Los Alamos Neutron Science Center (LANSCE), lead-bismuth loop experiments at LANL, and systems studies to evaluate technology readiness levels for ATW systems. Three of the ten AAA Fellows were also employed at the laboratories during 2001 (two at LANL, one at ANL-West). The AAA University Fellowship Program was described in detail in a paper that was submitted for presentation at the Winter Meeting of the ANS.[11]

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VII. PUBLICATIONS AND PRESENTATIONS

In the short time that the ATW and AAA university programs have existed, several technical papers have been published and many presentations have been made. Many of these have been mentioned herein, and others are referenced in the listed references in the bibliography. Many more technical papers and presentations will be reported in future years. In addition to technical papers and presentations, several articles have been produced and presentations have been given to provide publicity for the AAA Project and its University Programs. During FY-01 I presented AAA colloquia at many universities: the University of California at Berkeley, the University of Cincinnati, the University of Michigan, Purdue University, the University of Minnesota, the University of Wisconsin, the Idaho State University, and the North Carolina State University. During the summer a one-page white paper that summarized AAA support to students was produced for distribution by DOE/NE.[12] This white paper is updated intermittently and is distributed to interested parties or to answer inquiries. The AAA program has also received positive publicity in newspapers in Nevada. Finally, two articles about AAA university programs appeared in the Summer 2001 issue of the DOE/NE publication University Currents. One described the student support that was provided by the AAA Project,[13] the second described the AAA Fellowship Program.[14]

VIII. FY-02 PROJECTION AND FUTURE GROWTH

The total budget for AAA University Programs in FY-02 will be more than $7 M. It will include $4.5 M for the University of Nevada, $1.5 M for the Idaho State University, $0.5 M for the University Fellowship Program, and $0.5 M for LANL University Programs, which includes the directed university research. In addition, AAA technical staff will work with faculty at universities that support the Fellows, these staff will institute other research as needs arise, and interns will be supported at the labs during next summer.

The UNLV AAA UPP budget will increase to $4.5 M in FY-02, and an expansion of research is planned with this increase. Thus, fifty or more students may be supported at UNLV next year. In addition, investments in infrastructure will decrease in future years such that additional funding will be available for student-based research. With this increased funding, a fourth component will also be added to the UNLV UPP: international collaborations. A second university participation program was included in the FY-02 energy budget for Idaho State University. This earmark was for the Idaho Accelerator Center, and it will be used to initiate a number of new research projects in support of AAA goals, as well as to update equipment and to support infrastructure improvements at ISU. The University Fellowship Program will remain at the current level, but it may be modified to include one or more multi-year Ph.D. fellowships. Finally, the budget for directed university research was reduced slightly. As a result, research for the three supported universities will be reduced and re-focused to more directly couple their work with the needs of AAA technical staff.

Expansion of academic collaborations for the AAA Project beyond next year (FY-02) depends on projected budgets. AAA Program management intends at the very least to continue the existing programs (UNLV UPP, IAC at ISU, existing Directed University Research, and UFP). However, an increased budget may allow these programs to expand and others to be added. Thus, funds for university collaborations that support AAA research objectives could reach the order of $10 million per year within a few years.

IX. MEETING THE GOALS

In the introduction I described the goals of the AAA Project: to develop transmutation technology, to revitalize nuclear infrastructure, to provide a test-bed for advanced nuclear projects, and to resume an international leadership role. AAA University research supports all of these goals while expanding on and leveraging other DOE/NE programs such as the Nuclear Energy Education Research Program (NEER), the Nuclear Energy Research Initiative (NERI) as well as International NERI (I-NERI), and reactor research programs such as Generation 4 research. Much of the research and development that is being conducted for the AAA Project will support the development of Generation 4 concepts and nuclear systems. With more than 80 students supported this year, and the expectation of more than 100 in 2002, the contribution to the U.S. nuclear infrastructure is obvious. In addition, U.S. participation in international conferences will increase substantially as a result of the many research projects supported by AAA funding. This will demonstrate to the international community an emerging major role for the U.S. in this technology. As a prime example, the student mini-conference that was held in conjunction with the Winter Meeting of the ANS in Reno, Nevada in November 2001 was dominated by AAA-supported student presentations (half of the oral papers were for AAA-sponsored research). Thus, AAA University Programs strongly support the mission and goals of the AAA Project.

X. SUMMARY

The Advanced Accelerator Applications (AAA) Program will require a large cadre of educated scientists and trained technicians in the next decade or more. Other applications of nuclear science and engineering also

require increased academic and national infrastructure and student populations. The AAA Program Office has begun a multi-year program to involve university faculty and students in various phases of the Project to support the infrastructure requirements of nuclear energy, science and technology fields as well as the special needs of the DOE transmutation program. These AAA University Programs complement other DOE-NE programs such NEER, NERI and I-NERI, and reactor research programs like Gen-4 by connecting students to nuclear research projects in a wider variety of academic disciplines. In this paper I described university programs that have supported, are supporting, and will support the R&D necessary for the AAA Project. These include the Accelerator Transmutation of Waste (ATW) project, the AAA University Fellowship Program, the UNLV AAA University Participation Program, AAA Directed University Research, and several other efforts. The AAA Project is well poised to contribute to the future education of nuclear scientists and engineers while conducting research that is essential to the success of the project. Because of the success of this program in involving and educating students for future nuclear infrastructure and transmutation research, AAA University Programs will very likely grow substantially in the coming years.

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REFERENCES

1. M. L. CORRADINI, et al., "The Future of University Nuclear Engineering Programs and University Research & Training Reactors," ad hoc panel report to the DOE Nuclear Energy Research Advisory Committee, U.S. Department of Energy, Washington, DC (2000).

2. *Nuclear Education and Training: Cause for Concern?*, Nuclear Energy Agency, Organization for Economic Cooperation and Development, Paris, France (2000).

3. E. GREENSPAN and M. LOWENTHAL, "Improving Transmutation of ^{237}Np and Assessing Point Designs," final project report to Los Alamos National Laboratory, University of California, Berkeley, California (2001).

4. E. GREENSPAN, et al., "Feasibility Study of a Once-Through Molten-Salt Reactor for Nuclear Waste Transmutation," to be published in *Proceedings of AccApp'01*, Reno, NV, Nov. 8-14, 2001.

5. J. P. HOLLOWAY, "Fast Flux Depressions due to Nonelastic Effects in Lead and Bismuth," to be published in *Proceedings of AccApp'01*, Reno, NV, Nov. 8-14, 2001.

6. J. DAVIS, "Cross-Validation of Neutronics Tools for ATW System Design," to be published in *Proceedings of AccApp'01*, Reno, NV, Nov. 8-14, 2001.

7. V. V. KULIK, et al., "Space-time Dynamics Analysis of Source-Driven Subcritical Systems," to be published in *Proceedings of AccApp'01*, Reno, NV, Nov. 8-14, 2001.

8. C. A. BEARD, "Using Proliferation Risk as a Design Metric in the Development of Nuclear Systems," *Proceedings of the Ninth International Conference on Nuclear Engineering* (ICONE), Nice, France (2001).

9. A. HECHANOVA and G. CEREFICE, "Establishment of an Advanced Accelerator Applications University Participation Program at the University of Nevada, Las Vegas," to be published in *Proceedings of AccApp'01*, Reno, NV, Nov. 8-14, 2001.

10. J. W. FARLEY, D. KOURY, and D. L. PERRY, "Investigation of Corrosion of Steel by Lead Bismuth Eutectic," to be published in *Proceedings of AccApp'01*, Reno, NV, Nov. 8-14, 2001.

11. F. J. DAVIS, "AAA - University Fellowship Program for 2001: Process, Progress and Prospects," to be published in *Proceedings of AccApp'01*, Reno, NV, Nov. 8-14, 2001.

12. "Students supported by FY01 AAA funds," white paper transmitted to DOE/NE for distribution, July 2001 (updated intermittently).

13. "Students Supported by FY-2001 AAA Funds," *University Currents*, U.S. Department of Energy, Office of Nuclear Energy, Science and Technology, Summer 2001, p. 5.

14. "AAA Fellowship Program," *University Currents*, U.S. Department of Energy, Office of Nuclear Energy, Science and Technology, Summer 2001, p. 6.